AMACRO 2024, Problem set #1

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Consider the following model, with a TFP (Z_t) shock:

$$\begin{aligned} C_t^{-\sigma} =& \beta E_t \left(C_{t+1}^{-\sigma} \left[\alpha Z_{t+1} K_{t+1}^{\alpha-1} + (1-\delta) \right] \right) \\ C_t + K_{t+1} =& Z_t K_t^{\alpha} + (1-\delta) K_t \\ Z_t =& (1-\rho_z) + \rho_z Z_{t-1} + \epsilon_{z,t} \end{aligned}$$

I. **Build the model.**

1. Derive the model assumptions and optimization problem.
2. Reformulate the FOCs as expressed also in terms of Y_t.

II. **Build the Dynare file.**

1. By using the following calibration, fill in the parameter block.
   $\alpha = 0.3;\ \beta = 0.99;\ \delta = 0.025;\ \sigma = 3;\ \rho_z = 0.9;\ \sigma_z = 0.1$
   where σ_z is the shock's size.
2. Write the steady state block for $K_t,\ C_t,\ Y_t,\ Z_t$.
3. Write down the model in the model block.
4. Approximate the nonlinear equations in the system around the steady state, using 1st order Taylor approximation.
5. Generate impulse responses up to horizon 40 to a 1% TFP shock.

III. **Use the Dynare output.**

1. Derive the steady state values.
2. Derive and write down the policy rules.
3. Comment the generated IRFs to a technology shock, and store them into a .mat file.
4. Comment the simulated properties of capital and consumption.
5. Evaluate the sensitivity of results to varying calibration of parameters.